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COMPLETE SPECIFICATION

Sound Motion Picture Screen

I, HERBERT AUGUSTUS STARKE, a citizen of the United States, of 10561, Dunleer Drive, Los Angeles 34, California, United States of America, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to screens for the reproduction of sound motion pictures.

In prior art screens, beads and flake-like reflective material or the like which seek to improve diffusion of light, to avoid hot spots, and to improve reflection, actually serve to further decrease the effective angle within which full vision is possible. Such bead or flake material also contributes to the dirt-accumulating properties of the screen and makes cleaning thereof more difficult, or impossible.

Where perforated screens are used, a stroboscopic effect is evidenced, particularly in positions proximate to the screen wherein the audience literally suffers from "spots before its eyes."

Screens of conventional construction known to the prior art have proven vulnerable to vandalism whose prevalence in modern theaters is well known and which is evidenced by paper clips, staples, bent hair pins, soap, and the like, thrown or shot into the screen surface to mar or deface the same.

For sound motion picture work, permeability of the screen has been required for sound-transmitting properties but an excess of permeability results in the loss of desired light-reflecting properties. Perforated screens, made of an impervious sheet material of well-known construction, have sought a solution by providing spaced, clear-cut openings which, however, allow the passage and hence the loss of twenty percent of the light from the projector. In addition, so-called "hot spots" occur, and the impervious nature of the material between perforations reflects sound waves from the loud speakers positioned at the back of the screen, thereby setting up a back-stage echo or reverberation. Moreover, high frequency

transmission in particular is impaired, particularly in the upper frequency area, resulting in ragged sound qualities and uncomfortable hearing conditions from the standpoint of the audience.

Diffusion of the light from the screen has been imperfect so that a relatively narrow band of maximum visibility occurs directly in front of the screen with a falling off of clarity and light in the side sections and front seats of the theater, i.e., at angular positions of more than thirty degrees from a normal to the plane of the screen.

Conventional screens do not lend themselves well to shipment and require special crating and occupy excessive bulk inasmuch as they must ordinarily be rolled and not folded, notwithstanding that they frequently are upwards of 80 feet in width and approximately three-fourths of any such width in height. Furthermore, prior art screens; aside from being brittle and having unsatisfactory reflective, diffusive and acoustical properties, produce visual distortion in some or all colors of the spectrum, either initially, or by yellowing or discoloring with age. Depth perception as well as faithful reproduction of color, whose careful selection and technical achievement is so difficult, consequently suffers.

In view of the above and other considerations, it is among the objects of this invention to produce a screen of improved construction for sound motion pictures:

1. which has improved properties of reproductive fidelity over the range of the visible spectrum, as well as that of audio frequency,

2. which is further characterized by its ability to reflect light to a great extent and for a longer period of time than heretofore accomplished,

3. which is devoid of visual perforations,

4. which omits undesirable plasticizers and/or pigments,

5. which is virtually indestructible by intention or through neglect,

6. which presents a uniform effective surface,

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7. which is flame-proof, fungus-proof, and readily cleaned,

8. which is given and retains a pure whiteness on its outer visible surface without showing signs of age or discoloration,

9. which has optimum properties of sound and light diffusion and permeability where desired to eliminate back-stage reverberation while providing depth and accuracy in image reproduction.

The invention also has among its objects the provision of improvements over prior art devices heretofore intended to accomplish generally similar purposes.

According to the present invention, a screen for displaying sound motion pictures comprises a front sheet of relatively fine woven material so as to be partially reflective and partially translucent; a second translucent sheet of relatively coarser woven material superposed in contact therewith; and a backing sheet of opaque dark-coloured still coarser woven material superposed in contact with said second sheet, all said sheets being of such weave as to be permeable to sound waves.

One or more of the sheets may be formed of sections hemmed together, and more than one sheet may be hemmed, the hems of different sheets being parallel but staggered. The hems may be vertically disposed.

Herringbone webbing may be secured to the margins of the sheets with grommet means secured through said webbing and sheets in spaced relationship along the margins for securing the screen to a frame.

A flame retardant and/or a bleaching solution may be dispersed over the threads of the sheets.

The fabric may be treated with this solution by spraying and drying it thereon.

In order that the invention may be more fully understood a construction of screen according thereto is shown by way of example in the accompanying drawing, wherein:—

Figure 1 is a front view of the screen.

Figure 2 is an enlarged fragmentary view as of the upper left-hand corner of Figure 1.

Figure 3 is a sectional view taken as on a line 3-3 of Figure 2.

The screen consists of three layers of cotton, muslin, or the like, the first layer 10 being reflective and translucent and comprising a 128-thread count pure bleach material preferably of the greatest width obtainable.

The term "count" refers throughout to the number of threads per inch.

The second or intermediate translucent layer 11 preferably comprises a 112-thread count and is also pure bleach.

The term "pure bleach" implies a fabric free from any and all sizings or starch.

The opaque rearmost sheet 12 is prefer-

ably a 40×38 count material and is vat dyed a dark navy blue. This serves as a light stop to prevent audience visibility of the seam lines.

All the sheets are of such weave as to be permeable to sound waves. The plies give the picture a desired depth of focus.

First-grade cotton fabric should be selected, and the material should be free from slugs and pulled threads as well as from all starch or sizings. It is desirable to select the widest material available.

A herringbone webbing 13, dyed black, may be doubled and stitched to the sheets 10, 11, and 12 around their margins 14 by means of stitching 16.

Grommets, including a male portion 17 and female portion 18, at six-inch intervals or otherwise as required, are spaced along the webbing whereby the screen may be laced taut over any suitable framework, preferably by continuous lacing, loops being formed at each grommet and drawn over hooks or other holding means in accordance with good practice.

No sewing together of the layers 10, 11, and 12 is normally required but white nylon thread may be used for this purpose on screens larger than 18'×24' to prevent pumping or "breathing" of the plies due to the passage of low frequency sound waves.

All the selvages of the hem lines 20 are directed toward the rear of the screen away from the audience. Hem lines 20 occurring in different layers 10, 11, and 12, should be staggered to avoid lumpiness of the screen, and lines or areas impervious to sound. When the suggested methods of hemming are practised, the resultant hem lines will be invisible to the audience and sound will not be impeded. Scratches on a film run vertically thereof and the seam lines are arranged in the same direction.

After completion of the screen by the stitching together of its several parts, it is stretched tightly on a suitable frame and sprayed with Antoxol, or other appropriate flame retardant, and Textilana "N," or other appropriate water-wetting agent, both in aqueous solution. Both of the named substances, Antoxol and Textilana "N," are commercially available from Eronel Industries, of Los Angeles, California. To the above solution is also added a bleaching agent preferably of the nature of Tinapol "BVA" in the approximate amount of one ounce to one gallon of the aqueous solution. Tinapol "BVA" is commercially available from the Geigy Company, of Switzerland, which also has an office in Los Angeles, California, and elsewhere in the United States.

A screen prepared according to the above specifications properly transmits sound frequencies throughout the range of human

audibility emanating from the speaker system, and at the same time prohibits light rays from the back of the screen from penetrating therethrough. An optimum life-like quality and color authenticity is thereby given to the reproduction.

The performance characteristics of the above screen are indicated by the results of a screen brightness test taken at the Carthay Circle Theater, in Los Angeles, California, using the instant screen. The following are the positions on the screen at which readings were taken and also the positions of the brightness meter in each case:

1. POSITION OF BRIGHTNESS METER

- I Center aisle at the 9th row
 - II Right aisle at 9th row, approximately 45° off of horizontal axis
 - III Extreme left aisle at 9th row, approximately 60° off of horizontal axis
 - IV Balcony center
2. POSITION OF SPOTS MEASURED ON THE SCREEN
- A Left side, a spot 5 feet in and 6 feet from bottom
 - B Center, a spot 6 feet from bottom
 - C Right side, a spot 5 feet in and 6 feet from bottom
 - D A spot at the center of the screen

3. RESULTS OF MEASUREMENTS

Position of Meter	Spot Measured	Foot-candles on Screen	Foot Lamberts	% Reflectance
I	A	14.4	11.15	77.5
I	B	15.3	11.85	77.5
I	C	14.4	11.15	77.5
II	A	14.4	10.95	76.0
II	B	17.1	13.0	76.0
II	C	15.3	11.5	76.0
III	A	14.4	10.8	75.0
III	B	16.2	12.15	75.0
III	C	15.3	11.5	75.0
IV	A	17.1	13.2	77.5
IV	B	18.0	13.9	77.5
IV	C	16.2	12.5	77.5
IV	D	18.0	13.9	77.5

4. COLOUR TEMPERATURE OF LIGHT

SOURCE ON ABOVE TESTS

The colour temperature of the light source at the Carthay Circle Theater is 5600° Kelvin.

In the process of manufacturing the instant screen, it has been found desirable, following weaving of the fabric in the manufacturing process, to remove the sizing, wax, or the like normally utilized. The resultant sheen or gloss normally included upon the material is thereby eliminated to provide both a fabric and a reproductive texture of softer nature and more diffusive light-reflective qualities.

Any conventional spray system, such as DeVilbiss 785 nozzle E needle is adoptable. Fluid pressure of 10 to 15 pounds and atomizing pressure of from 40 to 60 pounds are generally used. The fabric should be thoroughly wetted out; super-saturation should be avoided in order to produce a dry feeling when touched with the hand, as opposed to a moist feeling obtained with some fibres which have been treated with a fire-retardant. Alcohol is added to this formula to speed drying and to reduce shrinkage. The alcohol may be increased with resulting decrease in amount of water used when still speedier drying or greater freedom from shrinkage is desired.

A preferred formula for a fluid for spraying

the screen when tightly stretched for such purposes is: five gallons of water, one gallon of alcohol, one gallon of Antoxol, one ounce of Textilana "N," and one-third of a teaspoon of Tinapol "BVA."

This invention features provision of an improved sound screen for the reproduction of motion pictures which can be viewed without light fall-off and with an absence of distortion at as much as 60° from the perpendicular. It likewise features a screen which can be readily folded for shipment in small compass, which resists ageing, is readily cleanable, and has good sound-penetrating qualities combined with excellent light-reflective and diffusive qualities.

What I claim is:—

1. A screen for displaying sound motion pictures comprising a front sheet of relatively fine woven material so as to be partially reflective and partially translucent, a second translucent sheet of relatively coarser woven material superposed in contact therewith, and a backing sheet of opaque dark-coloured still coarser woven material superposed in contact with said second sheet, all said sheets being of such weave as to be permeable to sound waves.

2. A screen for displaying sound motion pictures as claimed in claim 1 wherein one or more of the sheets are formed of sections hemmed together.

3. A screen for displaying sound motion pictures as claimed in claim 2, wherein more than one sheet is hemmed, the hems of different sheets being parallel but staggered.
- 5 4. A screen for displaying sound motion pictures as claimed in either of claims 2 or 3 wherein the hems are vertically disposed.
5. A screen for displaying sound motion pictures as claimed in any one of the preceding claims comprising herringbone webbing secured to the margins of the sheets and grommet means secured through said webbing and said sheets in spaced relationship along said margins for securing the screen to
- 10 a frame.
6. A screen for displaying sound motion pictures as claimed in any one of the preceding claims wherein a flame retardant is dispersed over the threads of the sheets.
- 20 7. A screen for displaying sound motion pictures as claimed in any one of the preceding claims, wherein a bleaching solution is dispersed over the threads of the sheets.
8. A screen for displaying sound motion pictures as claimed in any one of the preceding claims wherein the first sheet is free from sizing or starch.
9. A screen for displaying sound motion pictures as claimed in any one of the preceding claims wherein the first sheet is of cotton muslin.
10. A screen for displaying sound motion pictures as claimed in any one of the preceding claims wherein the second sheet is free of sizing and starch and has a bleached front surface.
11. A screen for displaying sound motion pictures as claimed in any one of the preceding claims wherein the second sheet is of cotton muslin cloth.
12. A screen for displaying sound motion pictures as claimed in any one of the preceding claims wherein the third sheet is of cotton muslin cloth.
13. A screen for displaying sound motion pictures constructed and arranged substantially as described with reference to and as illustrated in the accompanying drawings.
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Dated this 28th day of July 1950.

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Patent Agents for the Applicant.

FIG. 1.

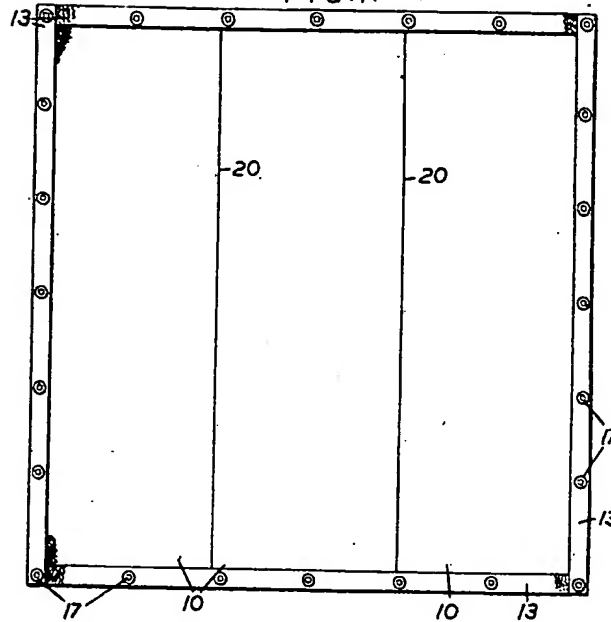


FIG. 2.

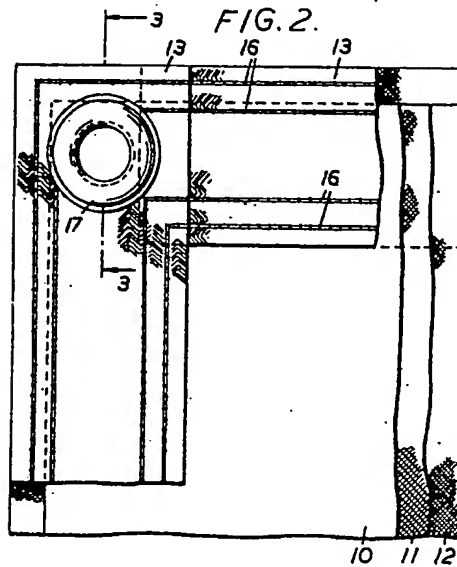


FIG. 3.

